



# Supply Chain Management: Monitoring Strategic Partnering Contracts with Activity-Based Measures

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**SECOND-GENERATION ABC SYSTEMS MAY BE THE WAVE OF THE FUTURE, NOT JUST FOR TQM BUT NOW ALSO IN SUPPLY CHAIN MANAGEMENT. IN A CREATIVE TALE OF A FICTITIOUS SMALL-TOWN BUSINESS, THE AUTHORS ILLUSTRATE WHY.**

**EXECUTIVE SUMMARY** Traditional management accounting systems are not designed to link nonvalue-adding activities and the resulting cost variances they can create to their causes, such as poor quality or inefficiencies in upstream activities. To improve supplier performance, management accounting systems should measure activities such as on-time deliveries and complete order filling.

**H**ighlighting the growing importance of the management accounting system's role in supporting supply chain management (SCM), a 2003 Institute of Management Accountants (IMA®) article began with this statement: "As competition continues to intensify, more and more companies are competing primarily on the nimbleness of their supply chains. Lean supply management, the growth of outsourcing, and the rise of

make-to-order manufacturing have made supply chain management an increasingly critical element in creating and preserving value."<sup>1</sup>

On the other hand, another 2003 IMA article summarizing a survey conducted by UPS Supply Chain Solutions, Alpharetta, Ga., reported that while 61% of responding CFOs believed SCM was crucial to their success, 62% believed that only incremental improvements were possible because of fragmented supply

chain control and the inability to measure supply chain costs.<sup>2</sup>

A 2005 IMA report concluded that “if your company doesn’t already have a system for vendor measurement, one should be developed. Among the key metrics for vendor performance: How does each one rate for on-time delivery, quality, and other factors that influence your operations? The price on a vendor’s invoice is only part of the picture. A low price grows costly when it’s accompanied by late deliveries and rejections based on quality.”<sup>3</sup>

Today the call continues for basic SCM measures capturing supplier quality, on-time delivery, and equally balanced measures for cost, quality, time, and effectiveness.<sup>4</sup> Thus, management accountants are being challenged to create SCM measures for these value chain activities. This challenge is also an opportunity to expand activity-based management (ABM) metrics to include supply chain activities.

At IMA’s 2005 Annual Conference, Michael Hughes, former CIO for Network Services Company, suggested three customer-oriented supply chain performance measures: complete order filling, on-time delivery rates, and warranty return rates.<sup>5</sup> In this article we expand on his presentation, demonstrating how the first two activities can be measured and reported within the management accounting system. We also add a third measure combining warranty and return activities with other downstream quality costs.

These measures are illustrated using a hypothetical scenario presenting problems created by suppliers, their causes, and the development of the SCM measures mentioned above. This scenario mimics real-world discussions and employs a fictitious company, Multree Homes, to illustrate the reasons why it is advantageous for management accounting systems to routinely report SCM measures such as complete order filling, on-time delivery, and the cost of poor supplier quality (i.e., a vendor performance index). Multree Homes produces manufactured houses and is the main employer in Multreeville, a small, fictitious town located in northern California.

Presenting these ideas in a case format can facilitate their inclusion in management accounting classes, especially at the introductory MBA level. This case can also

be used as a lead-in to a spreadsheet project for graphically reporting these SCM measures.

### **A TALE OF SUPPLIER WOES**

As usual, supplier problems dominated the weekly production planning meeting at Multree Homes. Bob, the vice president of manufacturing, began the discussion. “I see we’ve switched back to Woodsman Lumber for our framing stock. I thought we weren’t going to order any more lumber from them until they fixed their quality problems. What’s going on?”

“Quality’s not the half of it!” added Alice, the shipping and receiving foreman. “I’ve been trying to reach their Shipping Department for a week now, but they haven’t returned my calls. I can’t keep letting my people stand around waiting for deliveries that don’t arrive on time. Just last week, three of five orders were late by a day or more. I’ve also been caught shorthanded when deliveries arrived early. One of the five orders was delivered two days before we expected it. My people also seem to be spending too much time inspecting these orders. The biggest problem is with incomplete shipments. Only two of last week’s five orders were complete.”

“That’s not all,” John, the production supervisor, said. “Alice’s people aren’t responsible for inspecting the quality of the framing stock, like knots in the wood, warped studs, wrong lengths, and so on. My people do that when they frame the houses. Quality problems cause a significant amount of nonvalue-added activities in Assembly. I’ve also tried to call Woodsman about this, but my messages have gone unanswered, too.”

Tommy, the personnel manager, interjected: “I grew up with most of the people working in our plant. They tell me about their problems over weekend beers and football. Trying to fix quality problems results in many unfavorable cost variances, like direct labor rate and usage, direct materials usage, variable overhead spending and usage, as well as making it harder to meet our production quotas. These folks are really upset because bonuses are based on avoiding cost variances, and they’re not getting bonuses because of the supplier problems.

“Alice and John, I think I know why your phone calls aren’t being returned,” Tommy continued. “I have a

few friends at Woodsman Lumber. They tell me that if we ordered from them on a more regular basis, we might get better customer support.”

“I’m also incurring too many unfavorable labor variances,” Barb, the warehouse foreman, added. “It’s because of early and late deliveries, the need to order more lumber to protect against bad quality, and the extra forklift moves to Assembly to deliver more lumber as the framers run out of good-quality stock.

“Too much of my forklift driver’s time is tied up with moving studs. This also makes him unavailable when he’s needed for other pickups and deliveries. The Window-making Department and Cabinet-making Department have been complaining about not being able to get the forklift on a timely basis. Cabinets are piling up, waiting to be moved to the warehouse, and Window-making can’t get the stuff they need. I hear the window people are sitting around a lot doing nothing, too. I’ll bet they’re seeing all sorts of unfavorable cost variances, like the others!”

All eyes turned to Jean, the purchasing agent.

### **“DON’T BLAME ME”**

“Now wait a minute!” Jean jumped in. “Don’t blame me for all of these problems. My job is to find the least expensive lumber I can. That’s why we switch suppliers so frequently. Our company’s late founder, Jim Multree, and the late owner of Woodsman Lumber, Al Boulding, were lifelong friends. We’ve been doing business with this supplier for years. When we stopped ordering from them a few months ago, they lowered lumber prices for us to get our business back. Lumber prices are volatile. I have to live within my budget, too. I have to do whatever it takes to avoid unfavorable purchase price variances. That’s why I’m buying from them again. This is saving us money, as you can see by the favorable purchasing variances I’m creating.”

Jackie, the controller, joined the debate: “Well, Jim and Al are no longer with us, and others are running the businesses now. Getting quality materials from Woodsman was never a serious problem as long as we could stockpile enough lumber. This is one reason why we have inventories! Besides, our Raw Materials Inventory is a current asset and doesn’t affect our bottom line net income.”

“That may be so,” Barb interjected, “but all that extra lumber, especially the bad studs I have to store separately—either to return or to scrap—is causing a lot of nonvalue-added activities in Warehousing. These activities are resulting in even more unfavorable cost variances.”

“It also creates extra work for me, all of which is non-value-adding,” said Julie, the CFO and a Certified Management Accountant (CMA®). “Most of the Operations people complain about how cost variances in their departments are being caused by activities in other departments, such as Purchasing, from this lumber supplier problem. I spend way too much time investigating these variances after the fact, up to a month later, just to support Tommy’s belief that the cost variances cannot be used to evaluate and reward performance. The workers complain to Tommy. Tommy complains to me, and I’m the one who has to explain this to Sid, our CEO.”

“Let me explain my complaint about how we use cost variances,” Tommy continued. “The Framing Department gets its cost variance report, which is used to evaluate and reward those people. They don’t get rewarded because of the unfavorable cost variances caused by bad lumber. They have no control over the lumber quality, but they’re held responsible for the unfavorable cost variances occurring in their department. I don’t understand why management believes that a variance in a particular department is necessarily caused by the people in that department.

“Now the Framing Department manager can ‘appeal’ an unfavorable variance and claim it’s not his/her responsibility and shouldn’t be used in a performance evaluation. But, it’s virtually impossible to unravel an unfavorable direct materials usage variance to determine how much of it is really the responsibility of another department’s activities.”

### **SUPPORTING NEW STRATEGY**

“It seems our cost variance reporting system is the real cause of the problem!” Julie concluded. “When we evaluate performance, we rely too much on these so-called ‘hard numbers.’ As the boss used to say, ‘You can’t argue with the numbers!’ He failed to realize that hard numbers aren’t always the relevant information we need to make a management decision.

“This is why I try to stress relevance over hardness when measuring and rewarding performance,” she added. “Just because a cost variance occurs in one department, this doesn’t necessarily mean it’s caused in that department. If an Assembly Department variance is caused by activities in a previous department, should the Assembly people be held responsible for it when their performance is being evaluated and rewarded?”

“I agree!” Jackie chimed in. “This is why accountants are often called the ‘cops on the block’ and are seen only as ‘bean counters.’ Workers have this negative image of me because when they see me, it’s usually about their unfavorable variances. They feel that the beans we count aren’t relevant or accurate measures of their performance. Too often I’ve heard them say that traditional cost variance reporting systems are the ‘bane of productivity’ because of all this after-the-fact investigation and arguing over who’s responsible for the variances. They blame the accountants.”

“Well, I’m not sure I’m ready to agree with that!” Jean said. “My job is to buy materials at the lowest price. My ability to create favorable purchase price variances is the relevant measure of my performance.”

#### **REWARDING PEOPLE**

“Not if it causes all these problems down the line as we’re seeing with the lumber,” Bob argued. “I’ve never liked management’s reliance on accounting variances for rewarding people. As an industrial engineer, I’m well aware of the origin of this practice from Scientific Management theory. Scientific Management organizes homogeneous activities into separate departments (e.g., sawing, framing, painting, and plumbing). These separate departments (functional silos) operate independently from each other, or so the theory goes. Thus, each department should be responsible for its own cost variances.

“Nearly a hundred years ago, Scientific Management was an appropriate strategy for designing how work was done. Many hard-working, poorly educated people were available. When work was organized into specific tasks, workers could be trained quickly and easily in the ‘One Best Way’ to do that task. Companies could hire, train, and then lay off workers as needed. Departments were developed for each set of related tasks (such as welding,

painting, sawing, etc.). For example, production foremen trained workers how to shovel coal into a furnace. That worker was not responsible for the resulting heat, for cleaning up, or for keeping the furnace working right. His job was to keep busy shoveling coal.

“The Scientific Management theory’s ‘Keep Busy All the Time’ strategy maximized each department’s output. The resulting inventories allowed each department to keep busy all the time even though they worked at different paces.”

Bob continued: “This was the time of the first Industrial Revolution. Relatively expensive investments in plants and equipment were being made. By maximizing output, each department minimized its average product cost. The goal was to spread fixed costs over more products, thus reducing the average product cost. Cost accounting systems were created to support management’s need to know the average product cost within each department. Cost variances were then developed to identify where costs deviated from the plan.

“For our purposes, it’s Purchasing’s responsibility to buy materials, so Purchasing is responsible for purchase price variances. Production departments are responsible for using resources, so each foreman is responsible for his or her usage variances.

“The old concept that each department is independent of the others isn’t true. Quality problems hide in inventories, waiting to create unfavorable cost variances from the nonvalue-adding activities that poor quality causes down the line. From a competitive point of view, we can no longer continue to stockpile large inventories just to avoid quality problems with materials and sub-assemblies and keep everyone busy. Large inventories and bad quality cost us dearly. That’s why we’re trying to eliminate all the excess inventory.”

Bob then commented, “As the weather changes, I change my clothes accordingly. As we change our management strategy, perhaps our management accounting system should also be changed to better support the new strategy. Julie, as a CMA, do you have any suggestions?”

#### **IDENTIFYING SUPPLIER PROBLEMS**

“Let’s start by summarizing the problems and causes we’ve identified,” said Julie. She wrote the following

bullet points on the white board:

- ◆ *Deliveries often are not on time*, causing unfavorable cost variances in the Shipping and Receiving Department.
- ◆ *Deliveries often are incomplete*, causing more unfavorable cost variances in Shipping and Receiving.
- ◆ *Quality problems* cause unfavorable cost variances in Assembly and the Warehouse.
- ◆ We can't get adequate *customer support* because we don't order enough lumber on a continuous basis.
- ◆ *Unscheduled and extra material moves* create unfavorable cost variances in the Warehouse.
- ◆ We frequently switch suppliers, searching for the best lumber prices, to avoid unfavorable *purchasing variances*.
- ◆ *Cost variances* are our primary evaluation and reward measure.

"Our people are very unhappy," Julie observed, "because they are being punished for variances occurring in their departments, which they believe are not controllable and are not caused by their activities."

### PHASE 1: INSTALL A SECOND-GENERATION ABC SYSTEM

Once Julie identified the problems with this lumber supplier, she took a two-phased approach to solving them. First, she installed a second-generation activity-based costing (ABC) system to trace nonvalue-added costs (cost variances) back to Woodsman Lumber. Second, she created three critical ABM supplier measures to better monitor Woodsman Lumber's performance.

A second-generation ABC system requires workers to identify in real time the sources and causes of cost variances they are incurring. Poor quality necessitates activities to correct it. These activities result in cost variances. Through real-time input, nonvalue-added activities and their costs can be linked back to their causes (such as bad-quality lumber) and sources (such as Woodsman Lumber).

For example, too many warped studs cause framers to spend more time searching for good lumber. This activity causes unfavorable materials and labor usage variances and potentially labor rate and variable overhead variances within the Assembly Department. If extra lumber needs to be requisitioned from the Ware-

house, further cost variances may result there. As these activities happen, the extra resource costs are coded as being caused by the supplier's poor lumber quality. Similarly, labor variances at the receiving dock caused by early or late deliveries and incomplete shipments are coded to the supplier. The variance reports then organize cost variances by source and cause.

In contrast, traditional cost variance systems report variances by resource within each department. For example, the Assembly Department may have a \$250 unfavorable labor usage variance for the week. Traditional variance reports do not provide the relevant information needed for management to identify the sources and causes of this aggregate resource variance. Thus, the key information needed to monitor supply chain relationships cannot come from a traditional management accounting system.

To illustrate how a second-generation ABC system reports cost variances, assume warped studs caused \$4,000 of unfavorable variances, which included \$700 in extra materials usage, \$750 in additional labor, and \$250 in overhead, all within the Assembly Department. Another \$800 in unfavorable labor and overhead variances occurred in the Warehouse. Another \$500 of this variance happened in Shipping and Receiving for activities necessary to return the bad materials to Woodsman Lumber. The last \$1,000 in unfavorable variances resulted in Shipping and Receiving due to early, late, and/or incomplete shipments. In total, Woodsman Lumber purchases created \$4,000 in nonvalue-added costs. Instead of reporting these unfavorable cost variances as unknown, buried components within different resource cost variances assigned to departments, second-generation ABC systems report the entire \$4,000 unfavorable variance attached to its sources and cause (Woodsman Lumber warped studs).<sup>6</sup>

Without knowing which activities are causing variances, responsibility for them cannot be assigned correctly when evaluating and rewarding performance. By capturing cost variance sources and causes in real time, Jackie and Julie do not have to spend extra time investigating variances after they occur, interrupting workers and then trying to figure out how much of each resource variance (for example, materials usage, labor usage, overhead spending and usage) is caused by a par-

ticular activity. Second-generation ABC systems are based on the argument that ex-post investigation is a nonvalue-adding activity. Identifying the sources and causes of cost variances can be done more efficiently and effectively through a real-time reporting system.

Unlike traditional management accounting systems, a second-generation ABC system also provides the cost variance information needed for many appraisal, internal failure, and external failure costs in the Costs of Quality report. This information also is needed for Pareto charts and performance evaluations.

### PHASE 2: CREATE ABM MEASURES OF SUPPLIER PERFORMANCE

Installing a second-generation ABC system was the first phase of Julie's new SCM system. As she now knew the nonvalue-added costs for activities caused by Woodsman Lumber, Julie's second phase involved developing a vendor performance index (VPI) to measure the "real" cost of Multree Homes' purchases from Woodsman. This ABM measure relates purchase costs to the nonvalue-added costs created by the supplier. It is simply the ratio of purchase and nonvalue-added costs to purchase costs. Woodsman Lumber's VPI for last week is illustrated in Table 1.

The optimal VPI value is 1.0, which means that the supplier creates no nonvalue-added activities. Woodsman Lumber's VPI is 1.4. This means that for every dollar of purchases from Woodsman, Multree Homes really incurs \$1.40 in costs.

VPI requires that the user define which activities should be classified as nonvalue adding. In practice, the distinction between value-adding and nonvalue-adding activities can be blurred. It is really a function of use. A strict distinction focuses on the customer. Nonvalue-adding activities do not enhance the customer's value. A more liberal distinction may include all necessary activities as value adding.

For example, ordering activities are nonvalue adding under a strict definition, but value adding under the liberal definition. The Multree Homes management team decided that original ordering activities are value adding but that return authorization activities ("backwards logistics" activities) are nonvalue adding. Consistent with Total Quality Management (TQM), Multree

Homes' continuous improvement projects should increase the efficiency of value-adding activities. Thus, Julie is working on an EDI (electronic data interchange) purchasing system to replace Multree's paper-based purchasing system.

### Table 1: Vendor Performance Index (VPI)

VPI is a measure of the "real" costs of using a supplier. Purchases from Woodsman Lumber were \$10,000 last week. Bad quality, early or late deliveries, and incomplete shipments caused \$4,000 in nonvalue-adding activity costs. Woodsman Lumber's VPI = 1.4, as shown below:

$$\text{VPI} = \frac{\text{Purchases} + \text{Nonvalue-added costs}}{\text{Purchases}}$$

$$\text{VPI} = \frac{\$10,000 + \$4,000}{\$10,000}$$

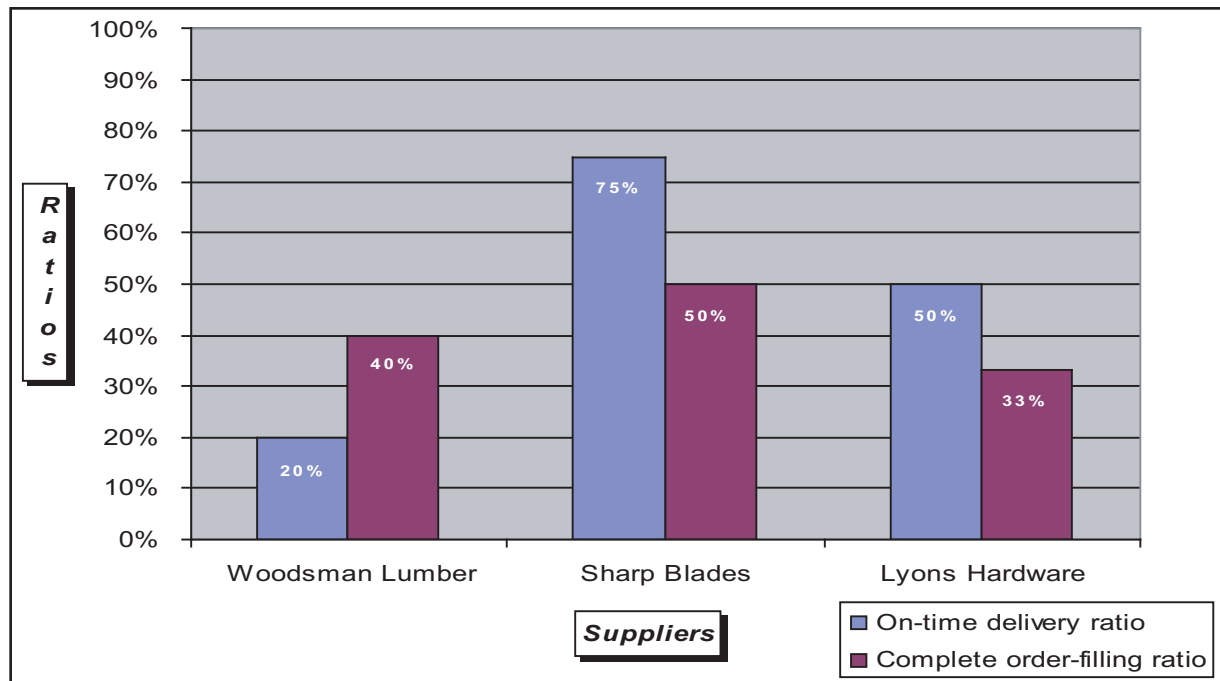
$$\text{VPI} = \underline{1.4}$$

### IMPROVE QUALITY OR ELSE

TQM also includes eliminating nonvalue-adding costs. Backwards logistics costs are caused by supplier quality problems and should be included in the supplier's VPI. By incorporating VPI in long-term supplier contracts (described below), purchasers require suppliers to assume the responsibility for fixing their quality problems or risk having their contracts cancelled.

If a strict definition of nonvalue-adding activities is used, however, the nonvalue-adding costs of the EDI system would be included in VPI along with Woodsman Lumber's costs that were caused by bad quality. Thus, a 1.0 VPI cannot be obtained. The lesson learned is that VPI requires a detailed analysis and necessitates defining which activities should be classified as value adding vs. nonvalue adding, so only the nonvalue-adding costs attributable to the supplier are included in that supplier's contract measures.

**Figure 1: On-Time Deliveries and Complete Order-Filling Ratios**



#### NONFINANCIAL MEASURES

Julie felt that her second-generation ABC system and VPI adequately measured all three TQM components (quality, service, and cost) when dealing with supply chain activities. She argued that separate measures of supplier quality and service are needed only when the ABC system is incomplete. Traditional (first-generation) ABC systems attach costs to activities (e.g., inspection or returning bad-quality materials). The costs are not considered “complete,” though, until nonvalue-adding activities are linked to their causes, such as poor quality or inefficiencies in upstream activities.

The operational managers at Multree still wanted more direct activity-based measures of the VPI cost drivers, however, so Julie developed two ABM ratios measuring on-time deliveries and complete orders. The on-time delivery ratio is the number of deliveries received when expected divided by the total number of deliveries. The complete order-filling ratio is the number of complete orders received divided by the total number of orders. Both ratios are illustrated for three suppliers in Figure 1.

Jean also wanted a distribution of early and late deliveries by supplier. This graph is presented in Fig-

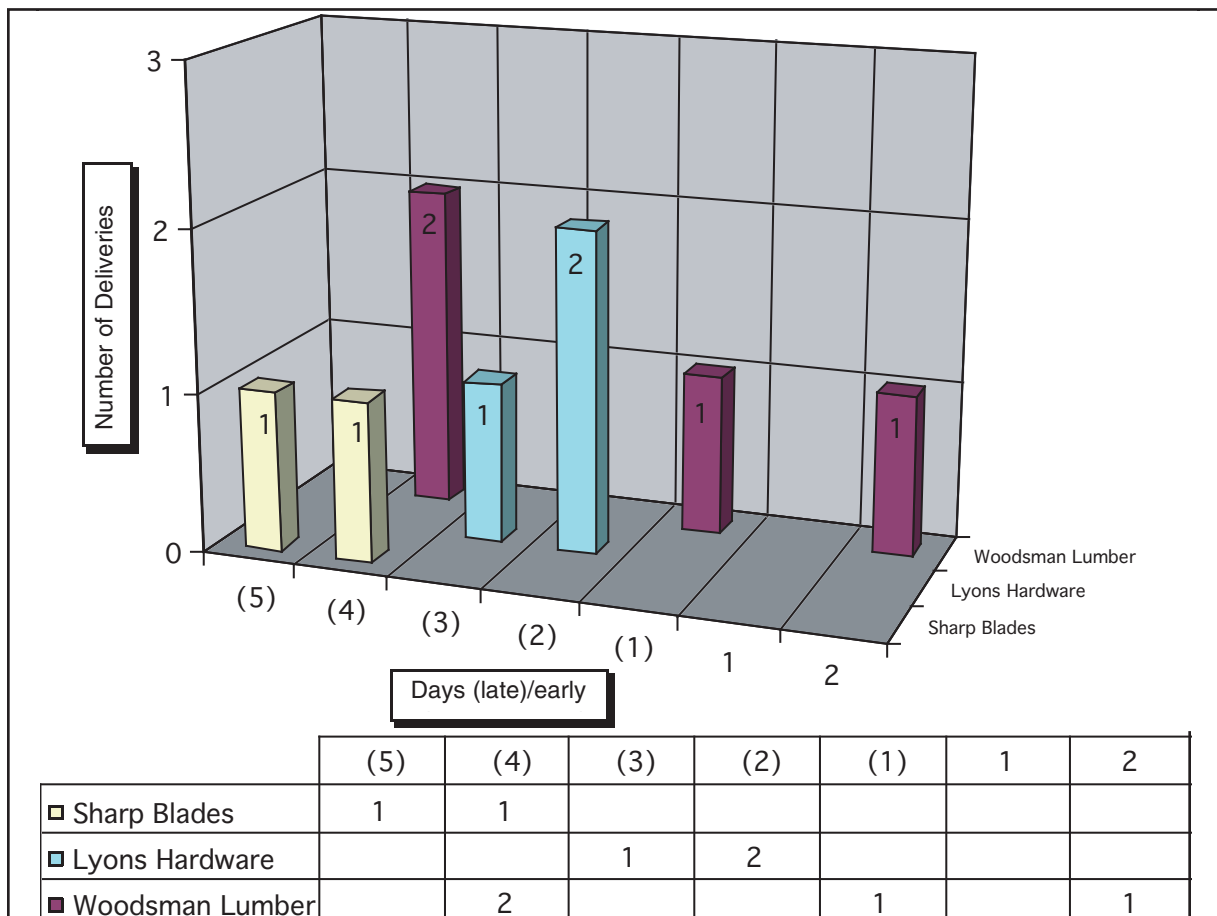
ure 2. Everyone felt that this distribution graph provided additional relevant information. Jean believed that supply problems worsen when the time between promised and actual delivery dates increases. She also believed problems from early deliveries are not as serious as problems from late deliveries. A more complete picture of supplier quality is available when the management accounting system provides on-time delivery and complete order-filling ratios as well as the distribution of early/late deliveries.

#### CONTRACTS MUST REQUIRE IMPROVEMENT

By now, all of the Multree managers believed that constantly switching suppliers in search of the lowest prices was not the answer to supplier problems. To improve on-time deliveries, complete order filling, and supplier quality, purchase prices have to be tied to these ABM measures. This can be accomplished through long-term supply contracts and strategic partnerships.

Jean went to work to develop a long-term contract with Woodsman Lumber. This contract provides for technical support to Multree Homes when needed. Specifically, requests by Multree Homes will be responded to within 24 hours. To keep the contract,

**Figure 2: Early/Late Deliveries by Supplier**



Bob has to be satisfied with the quality of this support. Thus, Woodsman Lumber now has a strong incentive to work with Multree personnel.

The contract also provides for price increases tied to the three performance measures Julie developed. For each 0.05 decrease in VPI, coupled with a 10% improvement in on-time deliveries and complete orders filled, Woodsman Lumber can raise its lumber prices 10%. From Multree Homes' perspective, the nonvalue-added costs saved (unfavorable cost variances avoided) will more than offset the higher material prices. If, however, the measures do not continuously improve as per an agreed-upon timeline, the contract can be cancelled. Julie created Woodsman Lumber's timeline graph, as shown in Figure 3.

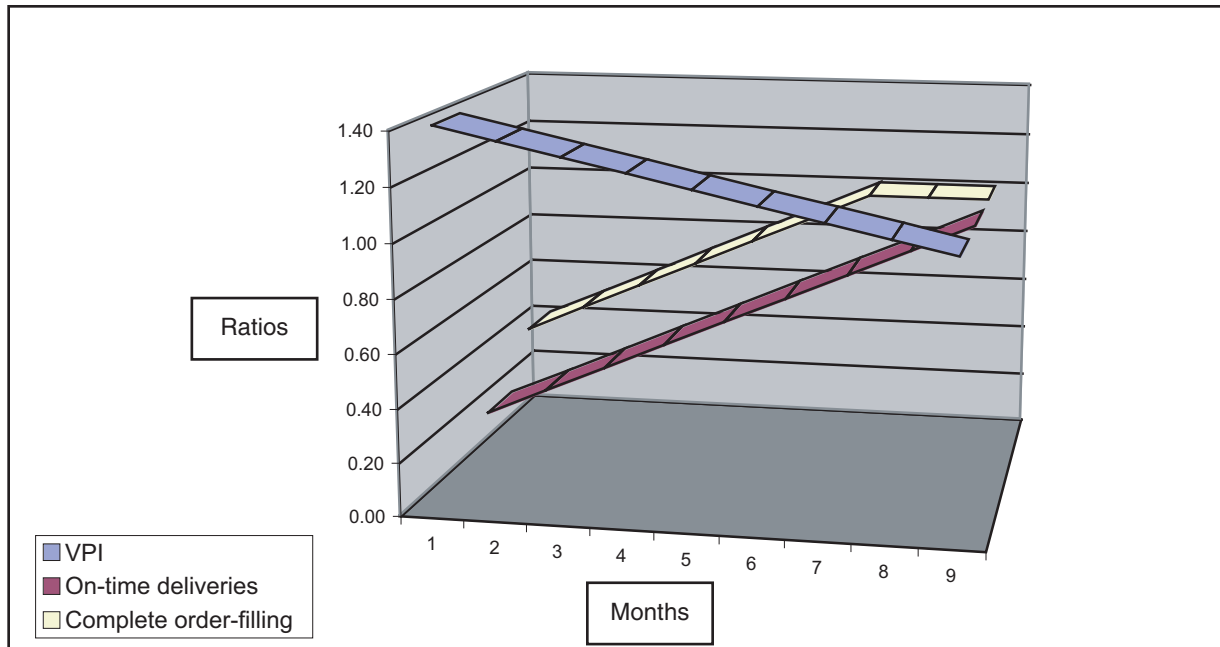
Figure 3 provides that the required budgeted

improvement in these supplier performance measures be built into the contract. Over time, each measure will be graphed separately, with actual performance graphed against budgeted performance. The graph shows how VPI is reduced by improvements in on-time delivery and complete order filling, coupled with quality improvements in the lumber delivered. As unfavorable cost variances caused by bad performance decrease (the VPI numerator), VPI decreases (it approaches the optimal value of 1.0, where no nonvalue-adding activities and unfavorable cost variances are created by the supplier).

**A NEW ROLE FOR PURCHASING**

As the purchasing agent, Jean's responsibilities have been changed. Standard prices are adjusted based on

**Figure 3: Contract Performance Measures**



the Figure 3 timetable for improvements. Because actual prices will increase as performance improves simultaneously with the standard price adjustments, no unfavorable price variances can result. If expected improvements do not result, however, actual prices will not change. Comparing the new higher standard price with the unchanged actual price, a favorable price variance results.

This is not rewarded because it is not good news. Nor should supplier price variances under such long-term contracts be used in Jean's performance evaluations. Jean's new primary responsibility is to negotiate this long-term contract, administer it, and serve as primary liaison in this strategic partnership.

#### **OUT WITH THE OLD, IN WITH THE NEW**

For nearly 100 years, traditional management accounting systems have supported the classic Scientific Management strategy of separation in which each department is evaluated independently with its own cost variances. Purchasing is responsible for purchase price variances but not any resulting variances down the

line caused by poorly performing suppliers. Instead, unfavorable usage variances that result in subsequent departments are considered their responsibility.

Only through appealing these variances when evaluating performance and through after-the-fact investigations is there any hope that the activities causing these variances can be discovered so that correct responsibility can be assigned. It should not be surprising or unusual to find that "upstream" activities can cause cost variances in many departments "down the line," contrary to the beliefs of the Scientific Management theory.

Traditional management accounting systems view departments and entities independently (e.g., separate companies like suppliers vs. manufacturers). Thus, current traditional reporting systems are not designed to support strategic value chain management. For example, with traditional management accounting systems, variances are reported within the department in which they occur. Without relating them to the activities causing the variances, such as poor supplier performance, the traditional management accounting system cannot provide information about supplier-caused problems.

These problems signal the need for strategic partnerships in the form of long-term supply contracts.

As competitive pressures force organizations to reassess supplier relationships, strategic partnerships will continue to grow in importance. To support these new TQM-based organizational strategies, management accounting systems also must change. Like Multree Homes, other companies must develop activity-based management measures to support their strategic partnerships. These measures include a Vendor Performance Index, on-time delivery and complete order-filling ratios, and a second-generation ABC system to provide the data.

The ABM measures are simple to create and display within a spreadsheet program. More importantly, they report activities in a way that can be easily understood by those who need to use the information.

By changing how we calculate and report cost variances, management accountants can provide more relevant information to better manage supply chain activities. Second-generation ABC systems also can be supported by ABM measures, which can be displayed graphically and incorporated into long-term supplier contracts. Here, we suggest three relevant ABM measures: VPI, on-time delivery ratio, and complete order-filling ratio. We suggest that these management accounting system components better support a TQM strategy and strategic cost management in general than do current reporting systems based on a Scientific Management strategy. ■

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## ENDNOTES

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